

Richmond Refinery LPS Bulletin – Reliability

Deisobutanizer (C-1400) Flooding



IMPACT ERM: 12224

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Orifices added to lower section of the tray 6 downcomer



Tenets of Operations Breached:

1. Always operate within design or environmental limits

URIP

Design/Care/Fix/Prevent

Incident Description:

C-1400 was experiencing flooding in the lower trays of the column. Through operational moves, flooding was reduced, but overall plant throughput rates were limited. A Gamma scan of the column while it was flooding was done to confirm this issue. A Pit stop was executed to address the problem.

Investigation Findings:

1. Prior to 2005, Alkylate rates were lower and these lower rates did not limit the process rates in the column. After the 2005 SD, the design of the column prevented pushing Alkylate rates higher due to fouling that was experienced at the top of the column. As a result, modifications were made to the column during the 2010 SD to resolve the fouling and this also allowed higher Alkylate rates to be achieved. The bottom of the column also required repairs to restore a failed downcomer on tray 6 to the original design specs. The cause of the damage in the bottom of the column is unknown (i.e. could not be pin-pointed), however, water damage during the 2005 start-up is suspected to have been the cause.
2. After the 2010 Major T/A, Alkylate rates were pushed higher due to the resolution of the fouling issues. These higher rates were below the column's design specs, however, the column experienced flooding in its lower portion.
3. Gamma scan results showed that there was a hydraulic limitation on tray 5. When the column was opened, no physical obstruction was found that would have caused the flooding.
4. The original column design of liquid downcomer clearance wasn't high enough to allow internal reflux at high unit feed rates. Subsequent modeling showed downcomer loadings were at the higher end of the acceptable range. This was not apparent before the 2010 Major T/A because the internal damage in C-1400 masked the design limitations of the column.

Recommendations/Actions Taken:

1. During the pit stop, the following modifications were made to the C-1400 trays and downcomers to prevent flooding in the future.
 - Orifices were added to the lower section of the tray 6 downcomer to reduce the resistance to liquid flow out of the bottom of the downcomer.
 - Deflectors were added to the vapor chimney open areas to reduce liquid entrainment to tray 6 and return fluid restriction of the vapor from tray 4.

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